SHOE WITH AN ADJUSTABLE SOLE

The present invention relates to a shoe presenting a sole of dimensions adaptable to those of the shoe user's plantar region, and a method of adapting the sole dimensions of said shoe to those of the shoe user's plantar region, in accordance with the pre-characterising part of the respective independent claims.

Shoes of the aforesaid type have long been known, as has the problem, confronted and described, of producing shoes the sole of which can be adapted to the particular dimensions of the shoe user's plantar region.

DE 59,317 describes a shoe presenting a sole comprising an insert made of a deformable material to enable the sole to be elongated, and screw members to maintain the sole in the desired elongated position.

US 5,792,912 provides a sole presenting inserts and/or apertures enabling the sole to deform in different directions to hence adapt to the particular dimensions of the shoe user's plantar region, and describes various types of means to maintain the sole in the preferred deformed position, namely members comprising cords, members of rack type, screw clamping members, etc.

Similar solutions are also described in US 641,642, WO 9628053, US 2,497,175, US 2,112,052, US 2002178617, US 2004211090, and US 3,541,708.

All these prior patents use, for maintaining the sole in the preferred deformed position, mechanical means which complicate shoe production and/or assembly, are not simple to implement, are subject to wear and, if broken, generally require the entire shoe to be replaced.

An alternative solution to the use of mechanical means to maintain the sole in the preferred deformed position is described in US 6,237,255, which uses a T-shaped rigid insert inserted into a suitably shaped seat provided in the body of the sole.

This solution also has drawbacks, first of these being the fact that the sole and insert allow the shoe to deform only into a predefined limited plurality of positions related to the presence on the insert of projecting elements which snap-engage respective cavities provided in the sole seat which houses the insert. The solution described in this prior patent also does not allow the sole to be maintained stably and durably in the preferred deformed position, it being sufficient to exert a tractive or compressive force along the longitudinal axis of the rigid insert to change the position of the insert and consequently the deformation of the shoe.

An object of the present invention is to provide a shoe presenting a sole the dimensions of which are adaptable to those of the shoe user's plantar region, and a method of adapting the dimensions of the sole of said shoe to those of the shoe user's plantar region, which overcomes the aforesaid drawback and in particular comprises, for maintaining the soil in the deformed position, means which are simple to produce and assemble, which enable the sole deformation to be adjusted such that it adapts in an optimal manner to the particular dimensions of the user's plantar region, and which ensure that the deformation is maintained with time even if the shoe is subjected to stresses tending to increase or decrease its deformation.

These and other objects which will be apparent to an expert of the art are attained by a shoe and method in accordance with the characterising part of

the independent claims.

The present invention will be more apparent from the accompanying drawings, which are provided by way of non-limiting example and in which:

Figure 1 is an exploded perspective view of a first embodiment of a shoe according to the invention;

Figures 2A-2I show nine sole variants seen from above;

Figures 3A-3B show a further sole variant seen from above, in its non-deformed and deformed position;

Figures 4A-4M are schematic cross-sections through ten variants of a deformable sole element, taken on the line 4-4 of Figure 1.

With reference to Figure 1, a shoe of the invention comprises an upper part or vamp 1, of type conventional to the expert of the art, fixed to a sole 2 in usual manner, for example by sewing or gluing, and an innersole 3 to be inserted inside the vamp, above the sole 2. The vamp can be made of any material suitable for the purpose, in particular at least partially elastic materials of the type usually used in the footwear field.

Advantageously, in proximity to its lower perimetral part which is to be fixed to the sole, the vamp can comprise inserts 1B of an at least partly elastic material to enable the dimensions of the vamp, and in particular its width, to undergo deformation.

The sole 2 shown in the example is a combination of two parts joined together, namely an intermediate part 4 the lower face 4A of which is partially in contact with the ground, and an outer part 5 comprising a plurality of elements to contact the ground and acting as a heel 5A and studs 5B. It should be noted that the outer part is conventional to the expert of the art and could also be formed in a different number of parts, for

example a heel part and a single front foot part, this outer part acting as an element for damping and optimizing the resting of the foot on the ground.

With reference to Figure 1, the intermediate part 4 of the sole 2 comprises several parts, namely deformable parts 6A, 6B and substantially non-deformable parts 7A, B, C; said deformable parts 6A, B enabling the sole dimensions to be at least partially varied and to adapt it to the dimensions of the shoe user's plantar region.

It should be noted that in the present context the definitions of deformable and non-deformable material are to be understood in the sense that a material is defined as non-deformable if it does not undergo modification when subjected to those same forces that would deform the deformable material.

According to a preferred embodiment, the non-deformable parts 7A-C of the intermediate sole 4 are made of leather whereas the deformable parts 6A-B are made of a deformable plastic material suitable for the purpose, for example an elastomer, in particular a natural or synthetic or vulcanized rubber, or an injected thermoplastic.

Preferably the deformable parts 6A-B present (Figures 4A-M) two coplanar flanges 8 connected together by an intermediate bellows part 9 which can have different geometries as shown in Figures 4A-M. In some embodiments (4A-G) the flanges 8 of the deformable parts are housed in recessed seats 10 provided in the non-deformable parts 7A-C and of shape and dimensions identical to said flanges, so that the flanges 8 and the upper surface 4B of the sole intermediate part 4 are substantially coplanar. The deformable parts 6A-B and non-deformable parts 7A-C are rigidly joined together preferably by moulding the deformable parts onto the non-deformable parts,

or by gluing or by sewing, or in another manner conventional to the expert of the art.

In other embodiments (Figures 4H-M) the flanges 8A and the entire deformable part 9 are integral with the ground-contacting lower part 5 of the sole. In this latter case the sole part 5 and the deformable part are made of the same material or of different materials, for example by normal moulding or injection moulding; the material of the part 5 has however a greater density than that of the part 4. Alternatively, the flanges 8A can be fixed in conventional manner, for example by gluing, sewing, co-moulding or injection moulding, to the leather sole 4, which can lowerly comprise seats (not shown) identical to the described seats 10. Alternatively, the flanges could also be provided below the parts 5B and fixed to the leather sole 4 together with said parts 5B.

As shown in Figures 4A-M, the bellows part 9 can have different shapes, for example it can have an upwardly or downwardly facing U or V shape, as shown in Figures 4A, B, M, or with two mutually inclined V's (Figure 4C), or a plurality of U's having greater dimensions at the centre of the bellows and orientated alternately (Figure 4D), or a series of long, narrow identical U's orientated alternately (Figure 4E), or with rounded ends and arms of the U's which converge when in the non-deformed position (Figure 4L), or a series of wide U's alternating with a central narrow U (Figure 4F), or a series of alternating inclined V's of different dimensions, longer centrally than laterally, and a part which is T-shaped in the non-deformed position and U-shaped in the deformed position (Figures 4H, I). To better house the particular shapes of the deformable parts, the walls of the seats 10 provided in the sole 4 for housing said deformable parts 9 can comprise inclined

walls which converge upwards 10A (Figure 4C) or downwards 10B (Figure 4D) to act as an abutment for respective walls of the bellows under non-deformed conditions. Advantageously these abutment surfaces are not connected together, so facilitating bellows deformation. In the case of downwardly converging inclined walls 10B, these enable a bellows of relatively large dimensions to be housed, while limiting the bellows surface which comes into contact with the ground.

Bellows-shaped deformable parts are preferred to flat deformable parts, i.e. those having a continuous closed cross-section, for example rectangular; in this respect, by virtue of the bellows the force required to widen said deformable part is less than that which would have to be exerted on said deformable part of it were flat. There is also a lesser risk of breaking the deformable part or of separating it from the non-deformable part when it is subjected to traction for its deformation.

It is also advantageous that the deformable part has a continuous elongate shape and is positioned symmetrical about a sole longitudinal axis S because this disposition and shape ensure a greater resistance of the deformable part and a more uniform sole deformation. This also limits in the shoe the number of deformable bellows terminal parts 13 open at the edge of the shoe sole.

In addition to different transverse shapes the deformable parts can also have different longitudinal extensions or shapes and positions.

Figure 1 shows a first deformable part 6A having a U shape which extends within that part of the sole from the plantar arch to the forefoot in correspondence with the outer edge of the sole, and with the terminal parts of the U located below the plantar arch; and a slightly arched second

deformable part 6B which extends transversely to the sole longitudinal axis S at the plantar arch. The first part 6A allows perimetral deformation i.e. a widening of the front part of the sole, while the second deformable part allows sole lengthening.

Figure 2A shows a first deformable part 16A having a closed shape substantially equal to the sole perimeter and positioned at the outer edge of the sole. This shape enables any part of the sole to widen. To improve this widening, to the first closed part 16A of Figure 2A a second part can be added which is identical to the first but provided in its interior, and indicated by 16B in Figure 2A.

Figure 2B shows a pair of deformable parts 26A with an undulated extension, they being disposed symmetrical about the sole longitudinal axis S in the forefoot and with the ends 26C terminating at the toe and at the plantar arch of the sole, and a second part 26B undulated transverse to said axis and provided at the plantar arch.

Figure 2C shows a first deformable part 36A extending substantially superposed on the sole longitudinal axis S from the toe to the heel region, and a second part 36B transverse to this axis and provided at the plantar arch.

Figure 2D shows a pair of deformable parts 46A in the shape of a squashed M extending symmetrically about the sole longitudinal axis S in the forefoot part and with ends 46C terminating at the toe and plantar arch of the sole, and a second elongated V-shaped part 46B with the apex of the V located at the heel, and its ends terminating at the plantar arch.

Figure 2E shows only one deformable part 56A, identical to the part 6A described with reference to Figure 1.

Figure 2F shows a deformable part 66A superposed on the longitudinal axis

S and extending from the heel region to the plantar arch region of the sole where it divides into two arched arms 66B symmetrical about the longitudinal axis S and extending to follow the sole profile and come together again at the sole toe.

Figure 2G shows a first part 76A substantially identical to the part 16A of Figure 2A, and a central part 76B substantially equal to the part 6B of Figure 1 but connected to the part 76A.

Figure 2H shows a plurality of deformable parts 86A and B forming a lattice with parts parallel and perpendicular to the sole longitudinal axis.

Figures 3A, 3B show arcuate deformable parts 96A disposed symmetrical about the sole longitudinal axis s in the forefoot part of the sole, with terminal parts 13 located at the plantar arch and toe of the sole.

To deform the shoe, forces F (Figure 3B) have to be exerted on the sole in a direction substantially perpendicular to the shoe perimeter to widen and/or lengthen or shorten the sole, i.e. the thickness of the deformable part which, for example, as shown in Figures 3A, 3B can pass from F1 to F2 (Figures 3A, B). According to the invention the deformation, whether in width or in length, is between 1 and 10 mm.

To maintain the sole of the invention in the desired state of deformation, the shoe innersole 3 comprises one or more suitably dimensioned rigid inserts 14. Preferably these inserts comprise a flat part 14A for overlapping the sole, from which two lateral parts 14B extend to lie along the sides of the vamp. Preferably the flat part 14A presents a grille shape with apertures 14C, The insert 14 is made of a rigid non-deformable material, for example metal or a plastic with similar rigidity characteristics. The insert is preferably rigidly fixed to the lower face of the innersole 3, for example it is glued

thereto or made by injection moulding or co-moulding with the innersole. With the insert shown in Figure 1, on inserting the innersole 3 into the shoe two different effects are obtained: the forefoot part of the sole 4 is deformed to a width L1 equal to the insert width L2, the sole maintaining this deformation by virtue of the presence of the rigid insert 14.

Depending on which part of the sole is to be deformed, inserts of greater or lesser size and of suitable shape can be used. For example with the cross insert 24 shown by dashed lines in Figure 2C, the sole can be deformed both in length, and in width in the forefoot region, and the deformation be maintained. If eliminating the arms 24A and leaving only the arms 24B, only length deformation is possible. The insert shown by dashed lines in Figure 2D and indicated by 34 allows width deformation only in the heel region.

To prevent the innersole 3 being able to remain raised from the sole 2 due to the rigid insert 14, the insert 14 can comprise means 18 to removably secure it to the sole. For this purpose the insert 14 can for example comprise, projecting from its lower face, externally threaded teeth 19 (Figure 1) to penetrate through holes 20 provided in the sole 4 and engage in threaded holes 5C provided in elements 5B (indicated by the arrow A) of the outer sole part.

According to the invention, for each shoe size of a shoe of the invention, a purchaser has available a plurality of different innersoles each having a different rigid insert. For example, if the purchaser takes a shoe of size 8, a plurality of innersoles will be tried all relative to a shoe of size 8 but with different rigid inserts suitable, for example, for a size 8 shoe with a wide, normal or narrow plantar region. Having selected the innersole which best

fits the purchaser's foot, the innersole is inserted into the shoe then, by virtue of the rigid insert secured to the innersole, the sole is deformed such that it adapts to the innersole dimensions and maintains this deformation during use of the shoe.

Hence by virtue of the invention, for the same shoe size the purchaser can adapt all or only certain parts of the sole to the extent of plus or minus about one half of a shoe size.

It should be noted that by virtue of the flanges 14B (Figure 1) of the rigid insert 14, the shape and dimensions of the vamp 1 can be at least partially modified, and in particular of its parts or inserts 1B made of at least partly elastic materials. In this respect, on inserting the innersole 3, not only a personally adapted sole widening but also a vamp widening is achieved by virtue of said flanges 14B.

Finally, it should be noted that the invention is described by way of example only, and that numerous variants are possible all falling within the same inventive concept, for example the sole 2 could be made in one piece entirely of plastic by replacing the substantially non-deformable leather parts 7A-C with plastic parts and making the elements 5A-5B and the deformable parts 6A-6B integral with said parts 7A-C, for example by normal moulding and/or injection moulding.